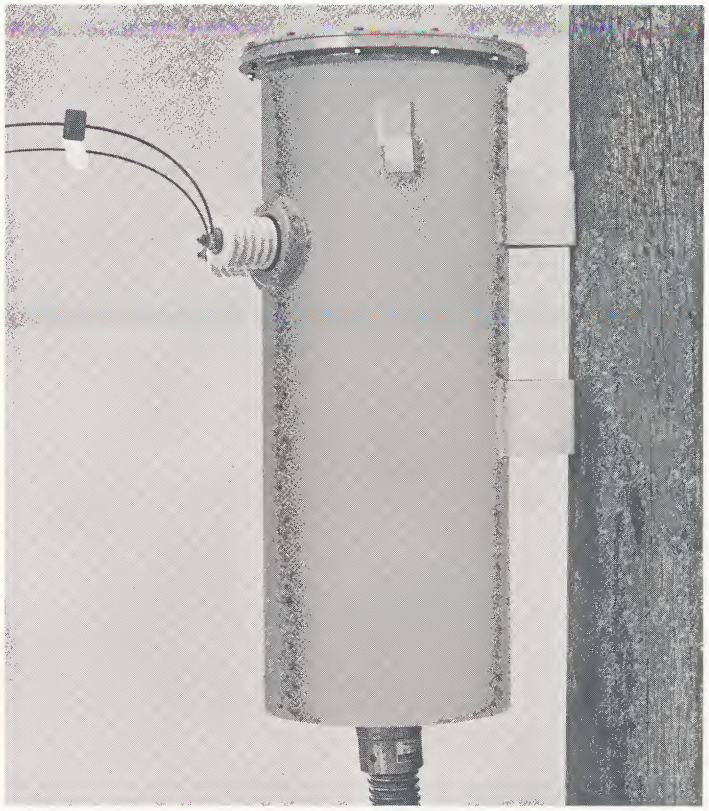
BROADBAND HF BALUN TRANSFORMER

MODEL 555-8

FOR EFFICIENT, ECONOMICAL, DEPENDABLE POWER TRANSFER FROM TRANSMITTER TO HF ANTENNA

- Transfers 25 kw average power (100 kw peak)
- Matches 50Ω co-ax to 600Ω balanced lines
- Covers HF frequency range, 2 to 32 MHz
- Efficiency greater than 97%
- Insertional VSWR below 1.2:1
- Terminal voltages balanced within 5%



INTRODUCTION

The Granger Associates Balun Transformer, Model 555-8, provides the most efficient means to transfer power from the transmitter to the antenna in a high-frequency communications station. The balun transforms the unbalanced coaxial transmission mode into the balanced open wire mode. The G/A balun is widely used with new log-periodic and rhombic antenna arrays and has found wide acceptance in modernizing older HF installation.

DESCRIPTION

With the G/A balun an HF station can use efficient, economical 600-ohm lines on the long runs from transmitter building to antennas and still use standard 50-ohm coaxial connections to the transmitter and to the antenna. The coaxial connection at the transmitter gives safety, flexibility, isolation and switching ease inside the transmitter building, and impedance characteristics often require a 50-ohm coaxial connection at the antenna.

The balun provides a dc path, with little or no resistance, from the center to outer conductor of the coaxial input. This feature is particularly needed with modern transmitters which use an interlock to prevent operation unless a dc path exists from the transmitter output to ground.

At no point in the 2-32 MHz range does insertional VSWR (voltage standing wave ratio) rise above 1.2:1, and the G/A balun operates at full rated power into a load VSWR as high as 2.5:1.

Insertion loss (in either direction) is below 0.15 db. With transfer efficiency greater than 97% from 2-32 MHz, power loss is minimized and antenna system range is improved.

The use of heliarc welded aluminum casings by G/A transmission equipment designers gives two major benefits to the user—1. Better heat transfer characteristics, and 2. superior corrosion resistance. Because G/A baluns are used in some of the most severe environments the aluminum can is further protected by etching and painting with Polyurethane Laminar X-500. Insulators on the balun are alumina-ceramic . . . an inorganic material that eliminates carbonization. Connectors use ceramic-to-metal seals and are attached to the balun body with leak-proof double o-ring seals. Because of the care exercised in design and manufacture, an occasional external inspection and cleaning are the only maintenance steps ever needed.

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ELECTRICAL SPECIFICATIONS

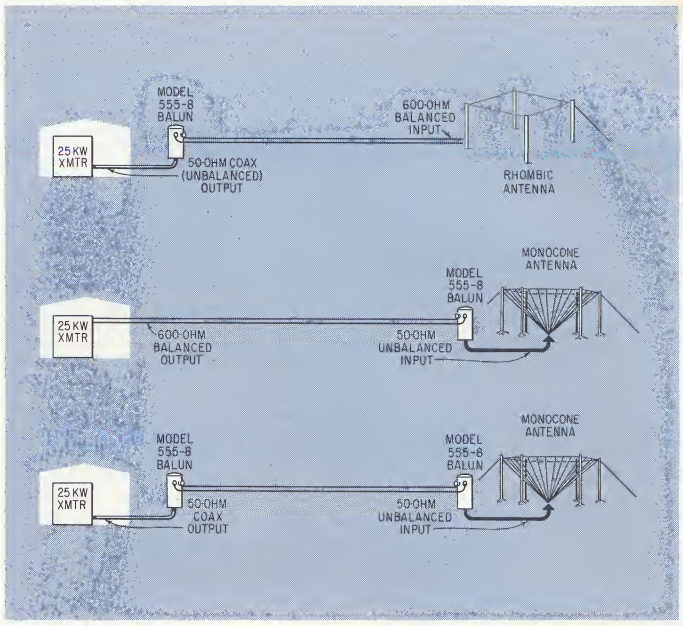
Power handling capacity: 25 kw average, 100 kw PEP
Frequency range: 2 to 32 MHz
Impedance transformation ratio: 50 ohms coaxial to 600 ohms balanced
Load VSWR: 2.5: 1 maximum
Insertion VSWR: 1.2: 1 maximum (with 1:1 VSWR load)
Efficiency: Greater than 97% (with 1:1 VSWR load)
Insertion loss: less than 0.15 db (with 1:1 VSWR load)
Balance: Terminal voltages are balanced within 5%

THERMAL SPECIFICATIONS

Internal cooling system: Natural convection of transformer oil
Coolant: Approximately 12 gal. transformer oil
External cooling system: Natural convection of surrounding air
Ambient temperature range: —40°C (—40°F) to +50°C (122°F)
Temperature rise of coolant above ambient: 50°C maximum

MECHANICAL SPECIFICATIONS

Container: 13″ cylindrical aluminum tank with pole-mounting lugs. Painted with Polyurethane Laminar X-500, light gray (#16473 per Fed. Std. 595)
Dimensions: Plan 16″ x 20½″; Height 35½″ (over-all dimensions, including connectors, terminals and mounting supports). See drawing
Net weight: 175 lbs (79.5 kg)
Shipping weight and volume: 250 lbs (113.5 kg); 13.5 cu ft (0.38 cu meters)
Connectors: Coaxial line 3⅛″ EIA female or 1⅝″ EIA female connector. Balanced line, insulating bushings with 10 ½″ spacing between terminal lugs

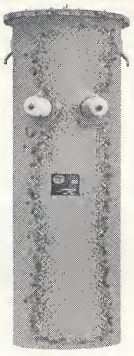


Typical applications of Model 555-8 balun transformers

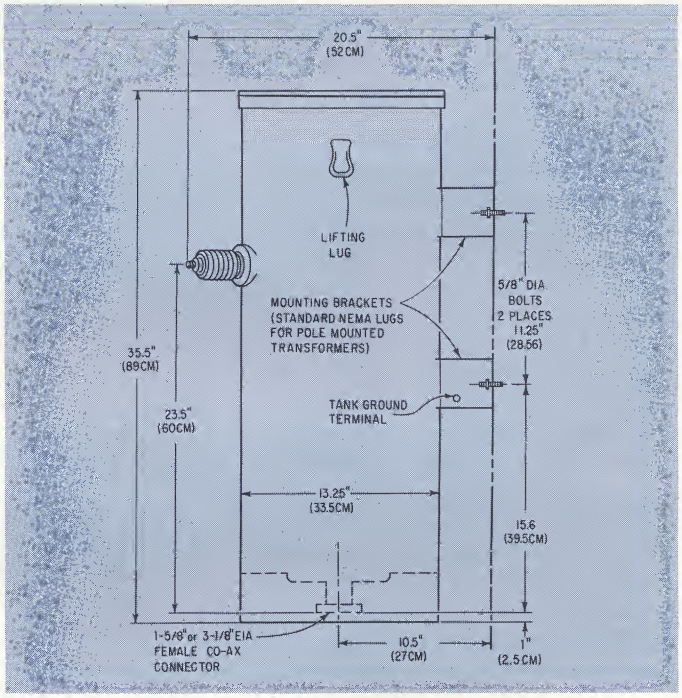
Mounting position: Axis of cylindrical tank on vertical, coaxial end down
Clearance for cooling: At least one foot clearance occupied by freely circulating air on all sides. Other equipment which is heated above ambient temperature should not be located so near the transformer as to cause an appreciable temperature rise due to heat transfer by radiation.

G/A BALUNS

This data sheet covers G/A Model 555-8; complete data is also available for Models 543 and 545.



	Model 555-8	Model 543	Model 545
Peak power:	100 kw	200 kw	30 kw
Average power:	25 kw	50 kw	7.5 kw
Frequency range:	2 to 32 MHz	3 to 30 MHz	2 to 32 MHz
Efficiency:	97%	97%	97%
Input impedance:	50 ohms	50 ohms	50 ohms
Balanced output impedance:	600 ohms	300 ohms	600 ohms
Insertion VSWR	1.2: 1	1.2:1	1.2:1



Dimensions, Model 555-8 balun transformer

MORE INFORMATION FOR YOU

Additional information on these products is available from the G/A communications engineering office nearest you, from Granger Associates, 1601 California Avenue, Palo Alto, California 94304; 818 18th Street NW, Washington, D.C. 20006; 35 Ben Boyd Road, Neutral Bay, Sydney, NSW, Australia; or from Granger Associates Ltd., Russell House, Molesey Road, Walton-on-Thames, Surrey, England.

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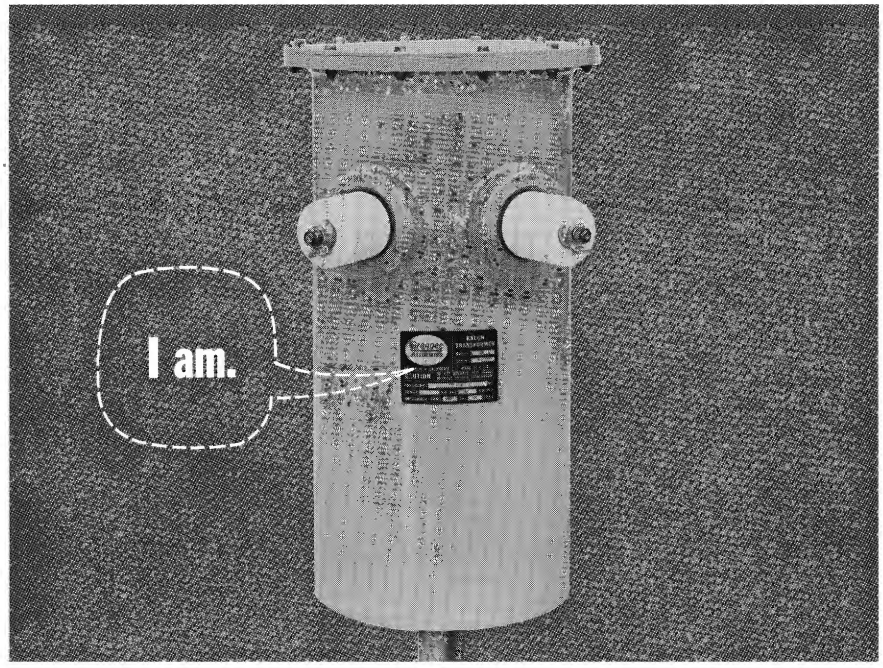
What's the safe, efficient way to bring transmitter power to an HF antenna?



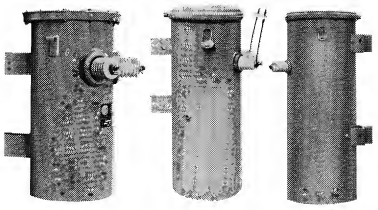
Granger Associates has the answer

now This Granger Associates balun transformer is the critical link in the safest, most efficient way to bring power to an HF antenna. For safety, you lead power out of the transmitter building on shielded co-ax. Then to obtain high efficiency at low cost, you couple the co-ax through a G/A balun to simple open wire lines for the long run to the antenna.

Unlike other balun transformers, G/A baluns do not restrict the transmitter's frequency or limit the power it can transfer to the antenna. All G/A baluns transfer power with more than 97% efficiency at any HF frequency. The largest will handle 50 kw average power and 200 kw PEP. They will operate into a load VSWR as high as 2.5:1. Moreover, insertion VSWR never rises above 1.2:1—which means that the transmitter can operate at full rated power without danger of creating excessive voltages or currents.

G/A baluns are sealed within a weather-proof container, need never be opened for maintenance, and have an expected operating life of 20 years in most environments.

Send for complete technical data on Models 543, 545 and 555.



Model 545
7½ kw average
(30 kw PEP)
2 to 32 MHz

Model 555
25 kw average
(100 kw PEP)
2 to 32 MHz

Model 543
50 kw average
(200 kw PEP)
3 to 30 MHz

Granger Associates

CAREER OPPORTUNITIES FOR ENGINEERS IN ANTENNAS AND TRANSMISSION PRODUCTS

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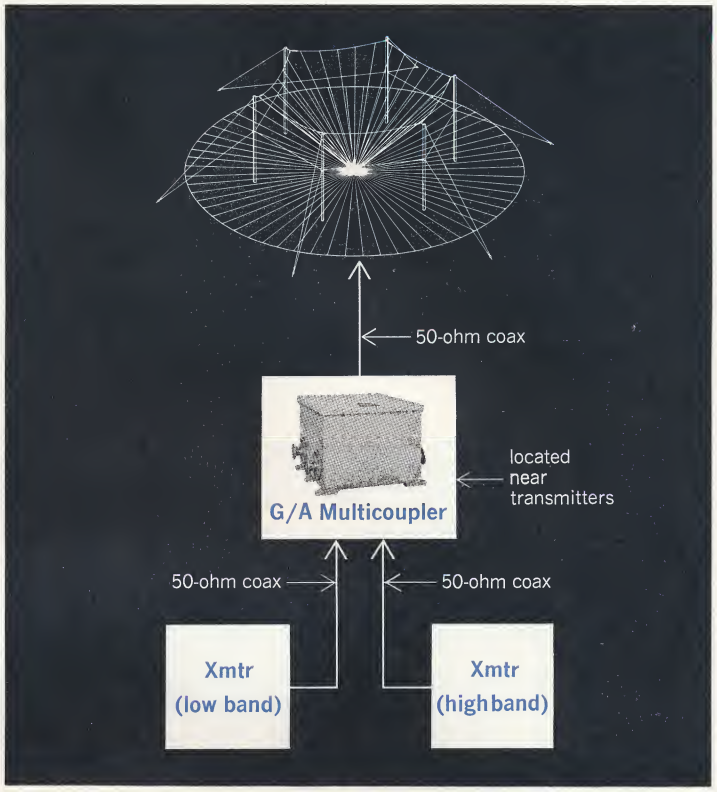
1601 California Ave., Palo Alto, California / Telephone: 321-4175 / TWX: 910-373-1291
Granger Associates Ltd.
Russell Hse., Molesey Rd., Walton-on-Thames, Surrey, England / Walton-on-Thames 29913

MODELS 520G AND 557

TWO TRANSMITTERS BROADCAST SIMULTANEOUSLY THROUGH ONE HF MULTICOUPLER.

- **NEW Model 557 handles 40 kw peak and 20 kw average power per transmitter.**
- **Model 520G handles 20 kw peak and 10 kw average power per transmitter.**
- **Reduce antenna requirements.**
- **Save on antenna ground space.**
- **Need no tuning or adjustments in operation.**



DESCRIPTION

Granger Associates multicouplers connect *two* HF transmitters to a single broadband antenna so that both transmitters can operate simultaneously without interference or interaction and without significant insertion loss. Each transmitter functions as though the other were not in the circuit—one in the *lower* portion of the antenna frequency range and the other in the *upper* portion.

Granger Associates has developed a wide range of multicoupler models to meet nearly every combination of HF communication needs. They are listed under ordering information on the back page of this data sheet.

A multicoupler consists of two bandpass filters and an output crossover network immersed in cooling oil and is connected as diagrammed in Figure 1. The filters are passive fixed elements which are permanently adjusted in the factory to pass all frequencies within the channel allocated to each transmitter. Consequently, transmitter frequencies can be shifted freely within channels without need for retuning the multicoupler.

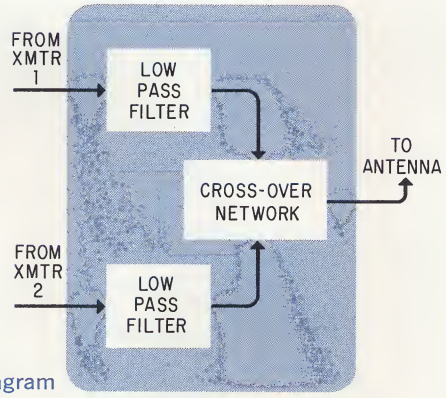


Figure 1. Multicoupler block diagram

APPLICATIONS

Transmitting multicouplers make it possible for stations to use the full capacity of modern broadband antennas for the first time. Wherever receiving stations lie at differing distances within the directional pattern of a single antenna, multicouplers permit simultaneous use of a "long distance" frequency and a "short distance" frequency—thereby accommodating a second HF communications circuit or expanding the area of broadcast coverage. The use of G/A multicouplers reduces antenna requirements and saves large areas of ground space. Where ground space is limited, multicouplers are the only practical means of obtaining the required number of transmitting circuits.

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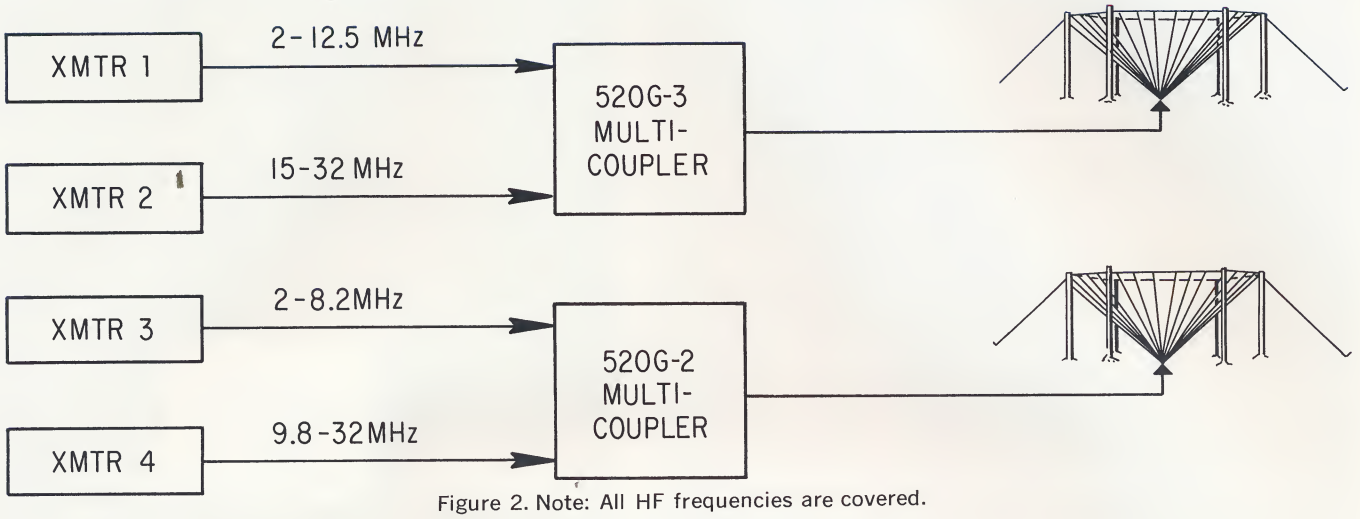


Figure 2. Note: All HF frequencies are covered.

A typical HF antenna/multicoupler system is shown in Figure 2. Through the G/A multicoupler the HF spectrum is divided between two or more transmitters—with the lower sub ranges for nearer receivers and the higher ranges serving more distant receivers. As the illustration shows, the entire HF spectrum is available to all transmitters.

The reception area for short wave broadcasts can be expanded by using a multicoupler to transmit the same program simultaneously on two suitably separated frequencies.

To complete the antenna/multicoupler system, Granger Associates has a complete line of broadband HF antennas. They are listed on a convenient HF Antenna Selection Chart available from any G/A office.

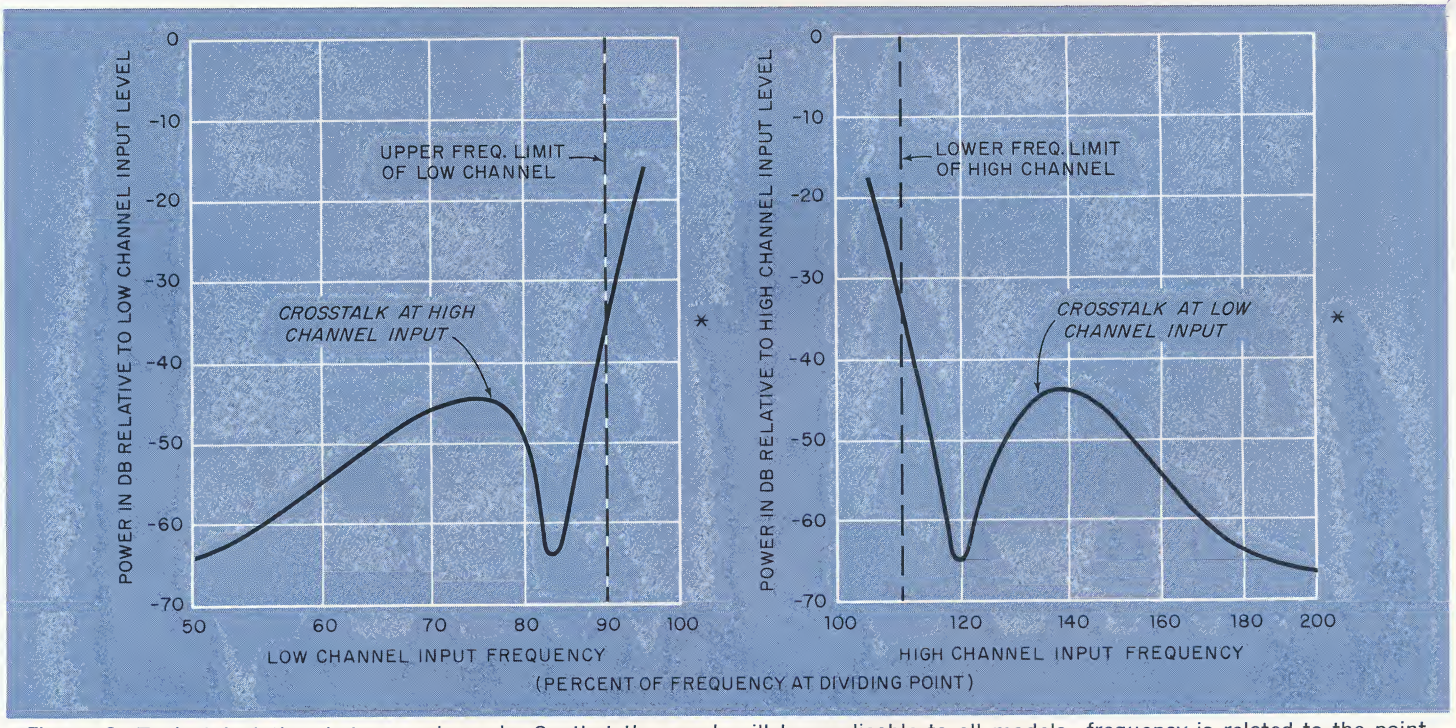
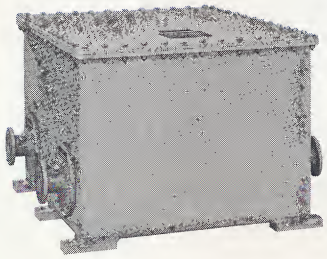


Figure 3. Typical isolation between channels. So that the graph will be applicable to all models, frequency is related to the point where the 2 to 32 MHz range is divided. *Note: 30db minimum isolation has long been the criteria for HF antenna siting.



ELECTRICAL SPECIFICATIONS	MODEL 520G	MODEL 557
Frequency Range	2 to 32 MHz divided into a lower and an upper channel separated by a narrow band of unusable frequencies. The upper limit of the lower channel must be at least 16.5% below the lower limit of the upper channel. The ranges of lower and upper channels in standard models are listed under Ordering Information. On special order, multicouplers may be obtained with the 2 to 32 MHz range divided at any point between approximately 4 and 22 MHz. The channel limits specified must be integral multiples of 50 kHz.	
Power Handling Capacity per Channel	20 kw PEP, 10 kw average	40 kw PEP, 20 kw average
Impedance at Inputs and Output	50 ohms nominal	50 ohms nominal
Insertion VSWR	1.2:1 maximum for either channel with a 1:1 VSWR load.	
Maximum Load VSWR	3:1	2:1
Isolation Between Channels	Energy passing through one channel into a matched load will be isolated from the input of the other channel by 30 db or more. (See Figure 3 for typical isolation characteristics.)	
Efficiency	Greater than 97.5%	Greater than 97.5%

THERMAL SPECIFICATIONS		
Coolant	Approx. 20 gal. transformer oil	Approx. 60 gal. transformer oil
Permissible Ambient Temperature	From −40°C to +50°C (−40°F to +122°F)	From −40°C to +50°C (−40°F to +122°F)
Internal Cooling System	Natural convection of transformer oil sealed within container to prevent oxidation. A pressure relief device is incorporated in the container preventing the build-up of excessive pressure in the event of improper operation.	
External Cooling System	Natural convection of surrounding air. Color of exterior (gray) has been selected to enhance transfer of heat from container to surrounding air.	

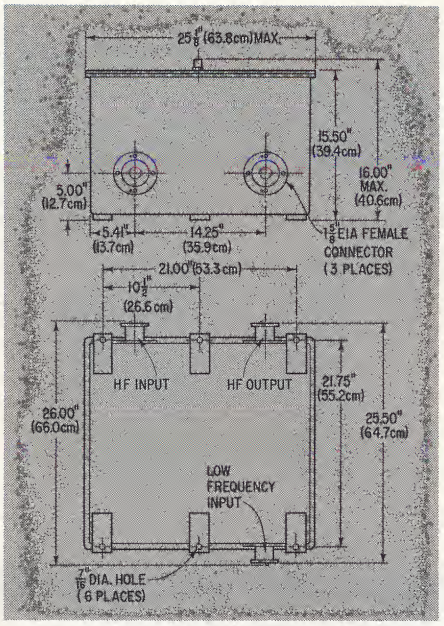
INSTALLATION REQUIREMENTS

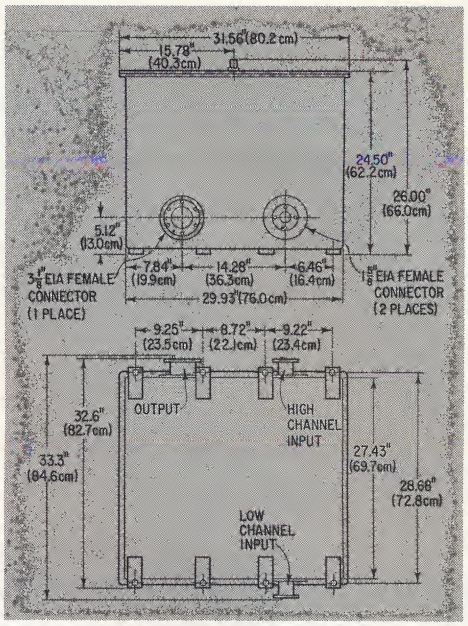
(MODELS 520G AND 557)

Mounting position: Feet on horizontal plane.

Shelter: For interior installation only.

Clearance for cooling: At least one foot clearance occupied by freely circulating air at the four sides. Other equipment which is heated above ambient temperature should be located three feet away from the multicoupler.





MECHANICAL SPECIFICATIONS

	MODEL 520G	MODEL 557
Container Material	Aluminum	Aluminum
Overall Dimensions (*including connector flanges*)	25⅛″ x 26″ x 16″	32 9/16″ x 32″ x 30″
Weight	Approx. 250 lbs.	Approx. 850 lbs.
Finish	Painted—light gray polyurethane	Painted—light gray polyurethane
Input Connector	1⅝″ 50-ohm EIA female coaxial connector. (3⅛″ available on special order)	1⅝″ 50-ohm EIA female coaxial connector. (3⅛″ available on special order)
Output Connector	1⅝″ 50-ohm EIA female coaxial connector. (3⅛″ available on special order)	3⅛″ EIA female coaxial connector
Shipping Weight	Approx. 325 lbs. (147.5 kg)	Approx. 950 lbs. (431.3 kg)
Shipping Volume	Approx. 14 cu. ft. (0.4 M³)	Approx. 37 cu. ft. (1.05 M³)

ORDERING INFORMATION

Multicouplers are available in the following frequency ranges:

10 kw Model Numbers	*Lower Channel*	*Upper Channel*	*20 kw Model Numbers*
520G- 1	2.0 to 3.5 MHz	4.2 to 32.0 MHz	—
520G- 7	2.0 to 4.75 MHz	5.7 to 32.0 MHz	557- 7
520G-10	2.0 to 5.6 MHz	6.7 to 32.0 MHz	557-10
520G- 6	2.0 to 7.35 MHz	8.8 to 32.0 MHz	557- 6
520G- 2	2.0 to 8.15 MHz	9.8 to 32.0 MHz	557- 2
520G- 9	2.0 to 9.55 MHz	11.45 to 32.0 MHz	557- 9
520G- 8	2.0 to 11.25 MHz	13.5 to 32.0 MHz	557- 8
520G- 3	2.0 to 12.5 MHz	15.0 to 32.0 MHz	557- 3
520G-11	2.0 to 12.85 MHz	15.4 to 32.0 MHz	557-11
520G- 5	2.0 to 13.4 MHz	16.1 to 32.0 MHz	557- 5
520G- 4	2.0 to 18.3 MHz	22.0 to 32.0 MHz	557- 4
520G-15	2.0 to 14.1 MHz	16.9 to 32.0 MHz	—

Other channel ranges are available on special order. See "Electrical Specifications."

MORE INFORMATION FOR YOU

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